FARMERS' BULLETIN 1080
UNITED STATES DEPARTMENT OF AGRICULTURE

Preparation of Barreled Apples for Market

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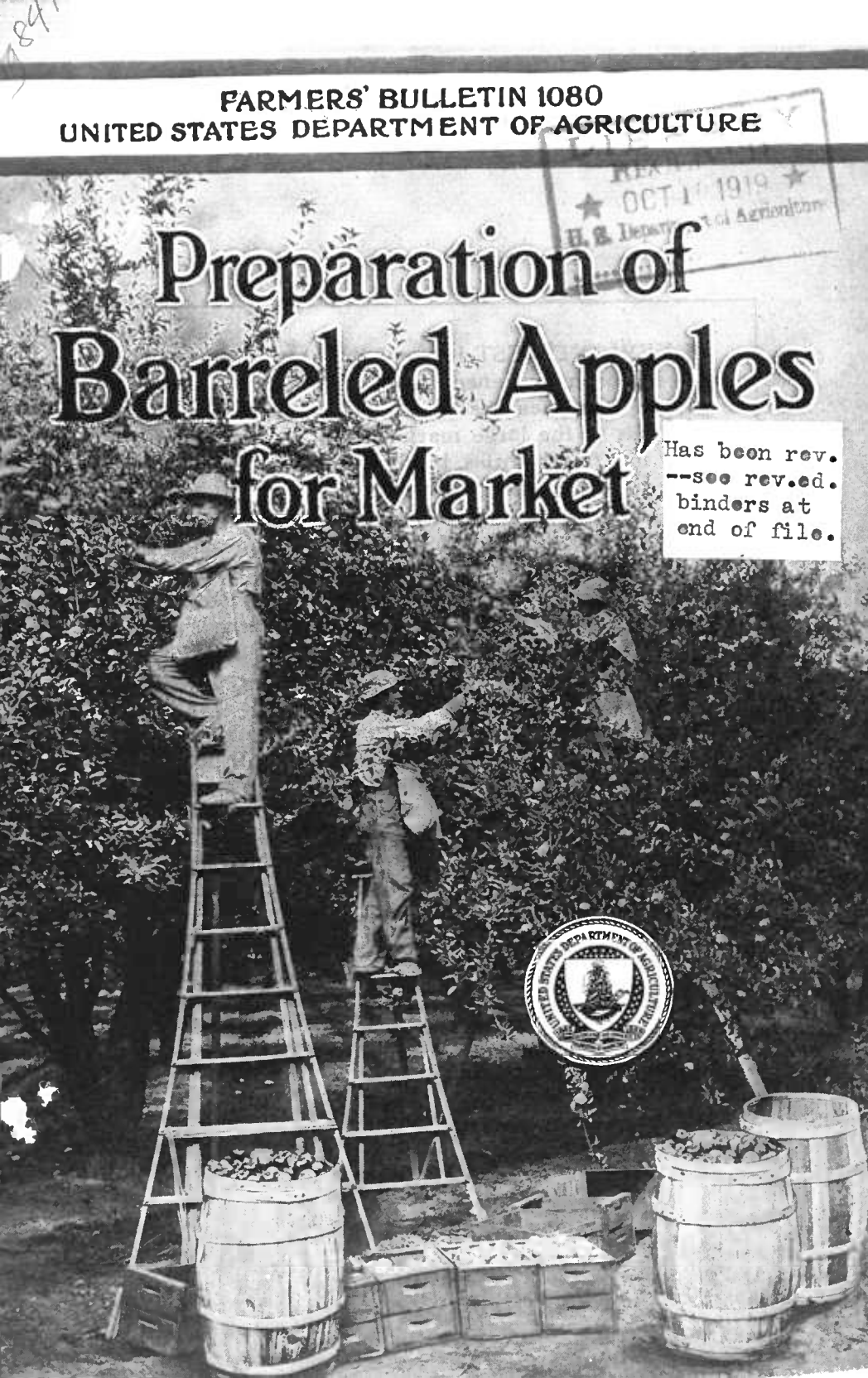

A NEW INTEREST in commercial apple growing has been awakened in the East and Middle West, caused in a measure at least by the comparative nearness to the large markets and the correspondingly low freight rates, by the relatively low cost of orchard land, and by the satisfactory prices which have been obtained in recent years for properly graded fruit. This interest has found expression in the erection of modern packing houses, in the increasing demand for labor-saving equipment, and in more careful grading and packing. There is still, however, a great need for orchardists to study the various operations involved in moving the crop from the orchard to the market in order to reduce the cost of handling and to raise the general standard of the barreled apple industry. This bulletin will provide growers with a basis for comparing their own methods with those employed successfully in representative orchards throughout the country.

Contribution from the Bureau of Markets
GEORGE LIVINGSTON, Acting Chief
Washington, D. C. September, 1919

PREPARATION OF BARRELED APPLES FOR MARKET

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CONTENTS.

THE COMPETITION of an increasingly large tonnage of carefully graded boxed apples has resulted in a more exacting market and has emphasized the importance of the closest study of the details of operation and equipment in the marketing of barreled apples. Well-chosen equipment, up-to-date methods, and careful supervision of crews must supplant the haphazard methods which prevail to some extent in all producing sections.

HARVESTING.

In making inspections of apples on the market during the course of the investigations on which this bulletin is based, special attention was given to the stage of maturity and its relation to the market value of the fruit. A large amount of fruit reaching the market each season is greatly impaired in quality by being picked at the wrong stage of maturity, either too early or too late. This mistake is caused both by a misunderstanding on the part of many growers as to when the fruit should be picked, and by the failure to interpret correctly under field conditions the factors indicating the proper stage of maturity.

Well-informed growers are often careless in the observance of the proper picking time, permitting other farm work, the condition of the market, or other factors to postpone the harvest.

TIME OF PICKING.

Varietal characteristics, seasonal variations, cultural practices, and other factors affect the maturity of apples, and it is difficult to lay down any fixed rules to determine the proper stage for harvesting. There are, however, certain indications of ripeness, such as red color,

color of the seeds, and the ease with which the stems separate from the spurs. These will enable any grower with some practice to recognize the proper stage.

The amount of red color is usually the basis for judging the time of picking red and striped varieties; in a majority of cases normally colored fruit of such varieties is ready to harvest if it has attained the proper size and separates readily from the spurs. Fruit is not ready to pick when it clings to the spurs so tightly that the stems are pulled out or the spurs broken.

Red color, however, is not always a reliable index, as the amount of color varies with the season, the size of the crop, the vigor and age of the tree, soil conditions, and other factors. For example, in years when bright days and cool nights come early in the season the fruit will color before reaching full size and maturity; while on the other hand, in seasons of warm cloudy weather, the crop may become overripe without the normal amount of color. Frequently a crop of pale fruit is allowed to hang so long in an attempt to secure good color that it is harvested in an overripe condition.

Whether or not the red color develops normally, a reliable indication of maturity is the ground color, which, when the fruit is ready for picking, should be turning from the clear green indicating immaturity to a whitish or greenish yellow.

With yellow, green, and russet varieties color can not be used to determine maturity. Such varieties are generally ready to pick when they have attained the proper size and the stems separate readily from the spurs. It is generally believed that the brown color of the seeds indicates full maturity, but this is not a reliable index, as it is very common to find colored seeds in immature fruit. It is certain, however, that the fruit is not ready to pick before the seeds turn brown.

Fruit that is harvested in an immature condition is inclined to scald in storage and in extreme cases may shrivel; on the other hand, if it is allowed to become overripe on the trees, the length of time it will keep in storage is reduced greatly. Some varieties when overripe crack in the blossom end and many drop badly. The grower must study each variety to get the best results in storage and in the market. An exception must be made in the case of summer apples, as they are not intended for storage. In order that these varieties may be permitted to ripen fully, it is a common practice in certain sections to mulch the ground under the trees quite heavily with straw and to allow them to drop rather than to pick them. It is also customary to thin out the larger apples of later varieties for cooking purposes as soon as they become large enough to meet the demands of the market.

NUMBER OF PICKINGS.

Most growers in all sections remove all of the fruit from the trees at one picking. Many, however, make two or more pickings during the season, especially when the fruit is not uniformly of good color, but is otherwise of high quality. The advisability of making more than one picking depends upon the extent to which the size and color of the fruit are affected by the load. The apples on the outside of the tree, especially the larger and better-colored specimens, are removed by the first picking to permit the limbs to lift and expose the uncolored fruit to the sun. This thinning also tends to bring about an increase in size of the fruit remaining on the trees. In the course of a week or ten days the second picking is made, when the remainder of the crop usually is removed. In a very few instances more than two pickings are made.

Two pickings are more expensive than one because of the additional time required to remove the fruit in this way, though the increase in the market value of the crop often justifies this practice. Again, if the crop is of low quality because of various blemishes, the value of the fruit usually is not sufficient to warrant the extra cost of more than one picking.

METHOD OF PICKING.

In picking apples the stem should be separated from the spur either by giving the fruit a slight rotating motion combined with a sharp upward twist or by exerting a slight pressure with the thumb or forefinger at the joint of the stem and spur, just as the fruit is pulled. The stem should not be torn out, as apples which are injured in this way are more subject to decay in storage.

If twigs or spurs are pulled off with the fruit they are likely to cause stem punctures during the hauling and packing operations. Also, because fruit is borne on the same spurs year after year, subsequent crops may be reduced. Some varieties lose their spurs very readily even where reasonable care is exercised by the pickers, but growers should insist that these spurs be removed from the fruit before it is placed in the picking receptacle even if the speed of the work is reduced. Satisfactory results are seldom obtained unless the work of each picker is inspected from time to time by the grower or a competent foreman.

PICKING UTENSILS.

Canvas sacks of various kinds and half-bushel baskets of the round type are used almost exclusively as picking receptacles for apples. In recent years the use of the picking sack has increased very rapidly, until now it shares equally in popularity with the basket.

It is generally advantageous to use both in removing the crop, as baskets are especially convenient for gathering fruit near the ground, while sacks can be used to advantage only when the picker maintains an upright position. Hamper baskets serving as picking utensils are encountered in the Delaware and New Jersey apple sections, where they are used extensively. Tin buckets with drop bottoms of canvas and several other patented receptacles designed to facilitate the emptying process are much used in certain localities, and ordinary metal buckets are used to a very limited extent.

Picking sacks vary widely in design and in the material used in making them. In the Potomac Valley region and in Virginia, many growers are employing a homemade sack of burlap which holds about three-fourths of a bushel. These sacks can be made easily and quickly from a burlap bag with comparatively no expense, and for this reason are employed by some growers in all sections; but, because such bags must be inverted to be emptied, which usually increases the amount of bruising, they are generally recognized as less desirable than the drop-bottom type. At the same time they may be used without appreciable injury to the crop if the fruit is of generally low quality or if of a variety not easily bruised, such as the Ben Davis.

FIG. 1.—Drop-bottom canvas picking sack.

The drop-bottom canvas sacks (fig. 1) holding about one-half bushel are equipped with straps that fasten them securely in front of the body and hold them in place as the picker is working from the ladder. The sack consists of a canvas tube held open at the top by a wire frame. The bottom of the tube is equipped with a snap or with rings so that the sack may be closed by folding up the tube and attaching it to a ring or hooks, as the case may be, on the front of the bag. These sacks are more convenient than baskets because they are held in place in such a way that pickers have free use of both hands. For this reason they can be used to good advantage where speed is an important consideration. Their chief disadvantage lies in the greater possibility of bruising the fruit as the picker walks about or presses the sack against the ladder or branches.

Another type of canvas sack has the opening in front but hangs under the picker's arm. This construction enables the picker to descend from the tree without bumping the fruit into the ladder.

Round half-bushel picking baskets (fig. 2), used in all of the eastern apple-growing sections, usually are made from staves, and are equipped with wire bails or wooden handles. The rigid sides of these

baskets protect the fruit from perssure, and in harvesting tender varieties this feature is essential. Pickers have a tendency when using baskets to place them in a crotch of the tree or to hook them over a limb, and then toss the fruit into them from a distance of several feet, causing severe bruises and often broken skin. If the baskets are padded or lined with corrugated paper the fruit will be protected to a considerable extent from such injury. Where ladder work is being done the baskets should be fitted with an S-shaped hook that enables the picker to move them frequently and use both hands for picking.

The proper method of emptying baskets or sacks should be impressed repeatedly upon the picker's mind. In emptying either, care should be exercised to avoid dropping the fruit. For example, if

FIG. 2.—Two approved methods of emptying picking baskets into field crates.

baskets are emptied into lug boxes the basket should be lowered to the bottom and inverted gently, or the lug box should be tipped so that the fruit rolls directly from the basket down the side as shown in figure 2. Drop-bottom sacks are so constructed that fruit can be emptied without bruising if the bottom of the sack rests on the bottom of the container when it is opened.

It is evident that all of these utensils have uses to which they are peculiarly adapted, and one can not be recommended to the exclusion of the others. The successful use of any particular picking utensil is largely a matter of management, and two different types can often be used to advantage.

LADDERS.

Several different types of picking ladders are in common use. The ordinary straight ladder is still used extensively in most sections, but is being displaced rapidly by improved types. The chief dis-

advantage of the straight ladder is the top-heavy tendency which makes it difficult to set it securely against the smaller branches without breaking them and knocking off fruit. One desirable modification of this ladder has a broad base and tapers toward the top. This construction gives a better distribution of the weight and makes it correspondingly easy to handle.

The pointed ladder is probably most satisfactory, as it is lighter and can be placed against a limb or fork that would not support a common straight ladder. For picking in the tops of high trees, extension ladders are very desirable, as they make it possible to gather fruit which could not be reached in any other way.

The use of such ladders is preferable to having the pickers climb the trees. Climbers in heavy shoes are likely to split the crotches and peel the bark. It is generally necessary, of course, to gather part of the fruit borne in the center of the tree by climbing, and where this is done much injury to the tree may be prevented if the pickers wear rubber-soled shoes or leather shoes without heels.

Stepladders of various kinds are especially satisfactory in harvesting fruit from small trees, and from the lower branches of large trees. The most desirable types are wide and flaring at the bottom, narrow at the top, and supported with but one prop. (See front cover.) Such ladders can be "set" quickly and securely, if the ground is level, without knocking off the fruit as do the long ladders which are leaned against the trees. As a general rule not enough consideration is given to the selection of ladders best adapted to the particular requirements of the orchard.

HANDLING THE FRUIT FROM THE TREE TO THE PACKING TABLE.

Where the crop is packed over tables that are moved from place to place in the orchard the fruit usually is carried in the picking utensil to the packing table. It is common practice for pickers to carry the fruit, but in so far as possible this should be avoided because it is both expensive and inefficient. Certain members of the crew should be assigned to the task of carrying the filled baskets to the table and furnishing the pickers with empty baskets. These men carry at least two full baskets of fruit from the tree to the table, whereas the picker makes the trip with one. If picking sacks are used, the fruit is carried to the tables in lug boxes which when full are too heavy to be handled by women or boys. The carriers also save much time for the pickers who are working on ladders or in the trees by taking the full baskets which are lowered by means of a rope and attaching empty ones. This makes it unnecessary for the picker to climb down to empty his basket.

Where the packing is done at a central packing house or at one permanent location in the orchard, the fruit is delivered to that place

in boxes, crates, barrels, or baskets, the kind of receptacle depending upon the locality.

Barrels are used most commonly in New England and in New York. They are also used a great deal in the middle-western States and by some growers in all sections. The use of barrels as field carriers not only makes unnecessary the expense of special orchard boxes, but also affords a package in which the fruit may be stored until it is packed. However, crates and boxes are preferable, as they are more conveniently handled and they may be stacked securely in storage or during hauling without bruising the fruit.

A very durable slatted crate which holds about a bushel is extensively used. Such a crate, illustrated in figure 3, has a solid bottom while the grooved top strips and half-round bottom strips fit together when the crates are stacked and prevent them from shifting. A majority of the different kinds of lug boxes are made by local manufacturers. The best ones holding about a bushel are made of heavy material, with hand holes at the ends and cleats across the top.

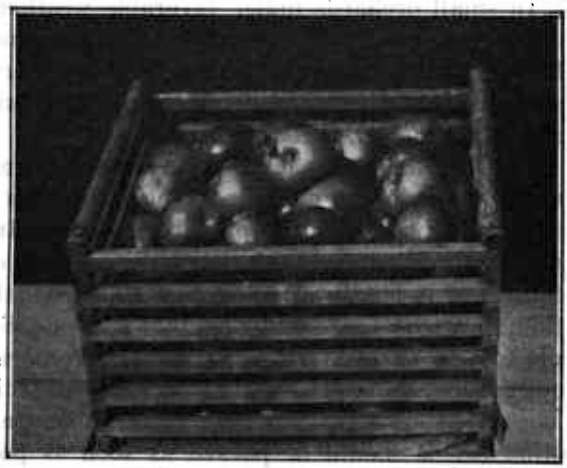

FIG. 3.—Slatted folding crate widely used as a field carrier.

Time will be saved if the pickers are at all times provided with an abundance of field crates to receive the picked fruit. The grower or foreman should see that these are distributed to the proper points in advance of the crew.

BASIS OF PAYING PICKERS.

In 90 per cent of the orchards investigated by the Bureau of Markets the growers were paying pickers on a straight day-wage basis; the remaining 10 per cent paid on the basis of the amount of fruit picked, and there are growers in all sections who are successfully employing this method. The speed of the work undoubtedly can be increased by paying the pickers on a piece-work basis.

This system may be employed advantageously where there is a labor shortage, or where there is low quality fruit, heavy dropping, or any other circumstance demanding the quick removal of the crop. It is the exceptional picker who will do his utmost when paid by the

day, and the exceptional one who will not pick more when paid by the piece. The pickers generally make better wages by this plan, and any tendency toward carelessness can be avoided by strict supervision. If the grower is not able to superintend the pickers, the damage resulting from carelessness may more than offset the advantage of the increased amount picked. It is possible to check up accurately on the work done by each picker by requiring that a check bearing an identifying number be placed in each basket or box picked. If the wages are adequate and the supervision is careful enough, the piece-work system can be employed successfully in picking crops of high quality.

GRADING AND PACKING.

In small orchards under favorable weather conditions apples are usually packed in the open, portable equipment being used, but in large orchards and in sections where unfavorable weather generally prevails during the harvesting season, the fruit is more often packed in central houses, tents, or sheds.

In New England, packing operations are very generally conducted under cover, as the weather in the fall makes it necessary to harvest as soon as possible. The prevailing temperatures at this time of the year favor common storage and the packing can be extended over a considerable length of time. Consequently, the practice in this section, and to a less extent in other sections, is to pick the fruit and place it in barrels, which are stored temporarily in sheds or other outbuildings, and to pack it later. If the fruit is to be held for any length of time it should be placed under proper conditions of storage, otherwise it should be packed as soon as possible and removed to storage. In producing sections farther south the common and most desirable practice is to pack the fruit as soon as it is picked and remove it to storage as quickly as possible.

The use of packing houses has increased rapidly during recent years and constitutes a development in the right direction. They have come into use in both large and small orchards, and many growers who operate only a few acres of apple trees have their packing done in a house or shed. This practice affords the following advantages:

(1) Shelter is afforded for an accumulation of unpacked fruit and the grading and packing can be continued without interruption in spite of unfavorable weather;

(2) Equipment, packages, and fruit are protected from the weather at all times;

(3) The use of a house encourages the installation of sizing machinery and other labor-saving devices which can not be used to advantage in the open; and

(4) The efficient organization of labor is simplified by having all of the work done in one place; there is no necessity for the confusion and loss of time which is caused when the outfit is moved frequently.

The tendency among the larger and more progressive growers in all sections is toward the use of packing houses equipped with machinery. In small orchards, when the climatic conditions are especially favorable, it may be advisable to pack in the orchard, but in most instances the use of a house or shed of some sort will insure better results.

Many growers contend that packing houses are not desirable in orchards located on rough, hilly land owing to the difficulty of hauling the loose fruit. However, some of the largest and most successful houses operated at the present time are located on hilly land, and they have the advantage of avoiding the difficulties encountered where the fruit is carried to the table and the equipment is moved from place to place on steep hillsides.

Packing houses are particularly desirable under conditions such as are found in the upland orchards on the steep sides of the Blue Ridge Mountains. In some of these mountain orchards growers encounter so much difficulty in moving their packing equipment that they select a central location for their packing operations, where they remain. As a rule, where the slopes are steep there is not enough level ground available to provide sufficient room for the equipment and the various members of the crew, and as a result the packers and sorters interfere with each other and limit the general efficiency of the work. Under these conditions the matter of temporary storage for both empty and filled barrels in the vicinity of the packing tables also offers a perplexing problem. Practically all growers who have used packing houses are emphatic in their indorsement of their use as compared with orchard packing.

GRADING TABLES.

Two types of grading or sorting tables are used almost exclusively where the fruit is graded in the orchard, and they are used to a large extent in packing houses also. These are the apron table and the canvas or burlap table.

Apron table.—The apron table or a variation of this type is commonly used in all sections. The table shown in figure 4 is typical of the kind used when packing is done in the orchard. Frequently tables similar to this are equipped with wheels so that they can be moved easily about the orchard. The bed of the table, which is slatted in such a way that the trash falls through, is inclined so that the fruit as it is graded rolls to the lower end, where, upon the opening of a stop or trap, it is lowered by means of an apron into the barrel.

The end of the table where the packing is done tapers down to an opening approximately 1 foot in width. A 50 or 75 bushel hopper or bin into which the fruit is emptied directly from the orchard wagons is sometimes attached to the apron table. (See fig. 5.) This

FIG. 4.—Apron grading table commonly used by barreled apple packers. The apples in the corner pockets are selected for facing fruit.

arrangement has the advantage of furnishing a continuous supply to the table and also saving handling the field containers in the packing shed. However, unless the bin is kept nearly full, the fruit is almost certain to be bruised in rolling down the necessarily steep

incline to the bottom. The weight of the fruit in the bin also makes it difficult to regulate the feeding and the apples often rush by the sorters faster than they can be graded properly.

The usual method where two grades are packed is to remove the culls and the second-grade fruit into baskets or barrels and to allow the first-grade fruit to "run" over the table. When one of two grades is sorted out, the sorters should always remove the grade which constitutes the smaller proportion of the fruit, in order to reduce the amount of handling to a minimum, and to allow the grade constituting the larger part to be run over the apron into the barrel. It is a mistake to run the first grade over the end of the table when this would necessitate the handling of the larger proportion of the apples. The man who packs the barrel is usually responsible for the

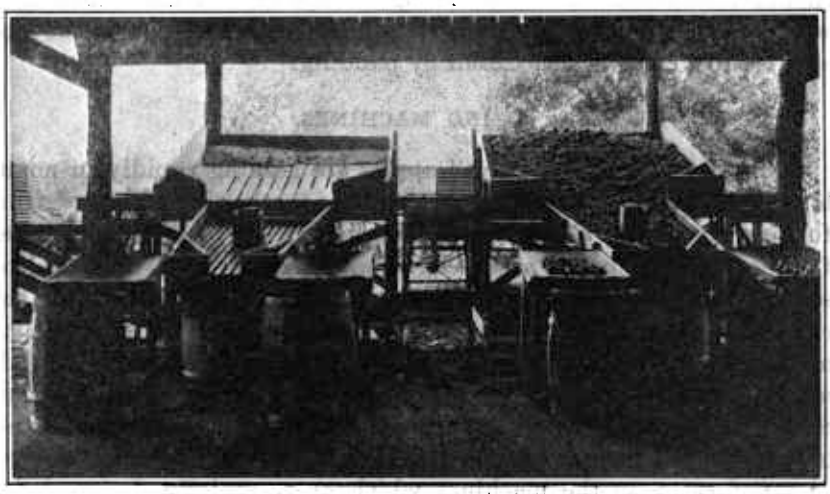

FIG. 5.—Receiving bins. The fruit is emptied directly from the orchard wagons into these large receiving bins. This provides a continuous supply to the packing tables.

maintenance of the grade. He has charge of the crew at his table and in addition to checking up the work, he supplements the sorting by going over the fruit as it passes into the barrel.

This type of table is popular because the work can be done rapidly. It is not altogether satisfactory, as the fruit frequently crowds past the sorters in a way which encourages carelessness. The actual sorting takes place as the fruit is being pushed or rolled along to the end of the table which is frequently kept so full that it can not be thoroughly inspected. Only with very careful management can the grades be maintained by the use of this table, especially if the fruit is not uniformly of good quality.

Canvas or burlap table.—The second type of grading table is made of canvas or burlap stretched over a rectangular frame. It is not fitted for running the fruit over an apron into the barrel as with

the apron table. The apples must be sorted by hand into baskets, in which they are lowered into the barrels. The advantage of this table is that all of the apples are subjected to careful inspection as they are removed by the sorters. Although as a rule this is a slower process than that of handling the fruit over an apron table, the sorters with practice soon become skilful and are able to handle the fruit very rapidly. When as much as half of the fruit must be removed from the apron table in the process of grading the same work could be done as rapidly and more accurately over the canvas-top table.

Care must be exercised in the management of either type if the best results are to be obtained. In the case of the apron table, the fruit is often bruised by crowding it along with the picking baskets as they are being emptied. With canvas-topped tables, the sorters should be cautioned about throwing the apples into the baskets into which the fruit is being graded. Injury from this source may be avoided to a considerable extent by padding.

SIZING MACHINES.

Sizing machines for barreled apples are gaining rapidly in popularity, although prior to five years ago the mechanical sizing of fruit for barrel packing was generally considered impractical. Machines for the sizing of boxed apples have been used in the Northwest for several years, but these operate on a different principle from that employed in barreled apple sizing machines. The most popular machines used for boxed apples size by weight while practically all machines used for barrel packing size the fruit by measurement. Some growers have obtained the machines used in the Northwest and have employed them to size barreled stock, but they have not proved as satisfactory as the machines which are especially designed for this purpose. They are constructed to size the fruit more accurately than is necessary for barrel packing and for this reason the capacity is very much less than that of the machines which size by measurement.

At present sizing machines are being used to a greater or less extent for barrel packing in all sections to meet the demand for apples that are uniform in size. The commonest practice throughout the barreled apple sections is to separate the fruit into two standard sizes 2¼ inches to 2½ inches and 2½ inches and larger. Such sizing is customary whether the grading is done with machinery or not, but it can be done more rapidly and accurately by the mechanical sizer. The use of the machine enables the grower to give more attention to the grading of the fruit, as the sorters are not concerned with the size classification. Where greater uniformity is desirable the machines are equipped to sort the fruit into variations of one-fourth inch,

and where this is done the mechanical sizer is of even greater value, as a uniform pack may be secured with inexperienced help.

The sizing machines used most extensively for barrel packing are essentially simple in construction. They consist of two parts—canvas conveying-belts on which the fruit is sorted, and the sizing device proper. The fruit is delivered to the grading belt as it comes from the orchard and is sorted as it moves toward the sizer.

One of the most popular types is equipped with endless chain belts about 2 feet wide, composed of rings of a certain size. (See fig. 6.) Two to four of these belts are uesd and are arranged in series so that the fruit progresses from the smallest to the largest rings. As the apples are delivered onto these chain belts from the grading belt they either drop through the rings of the first or are carried on to the next.

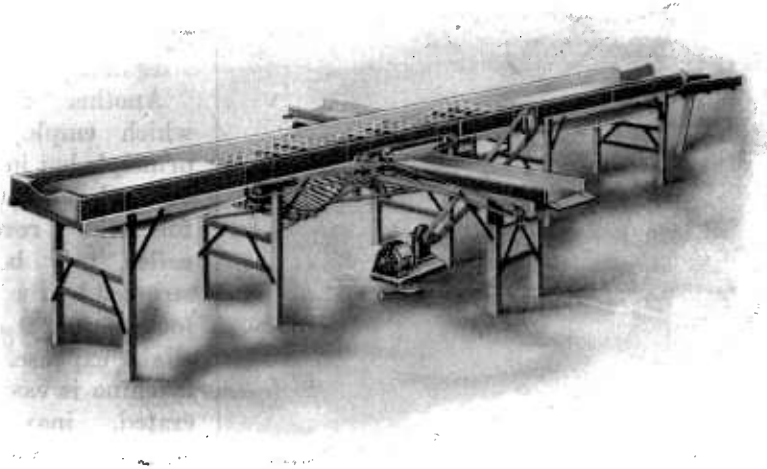

FIG. 6.—Machine equipped with sizing belts made of linked rings.

Where two chain belts are used the fruit too small for packing drops through the first, which is usually composed of 2¼-inch rings. The rest of the fruit is carried to the second chain composed of 2½-inch rings through which all the apples between 2¼ and 2½ inches drop. Those remaining are carried by a short conveying belt to a packing bin equipped with an apron. This size includes all apples 2½ inches or more in diameter.

The sizing chains are inclined or otherwise arranged so that the position of the fruit is changed several times as it is carried over the rings. This is necessary to secure the measurement of the transverse diameter, which is the dimension used as the basis for all sizing. Apples occasionally fall onto the sizing rings so that they are measured by the longitudinal diameter, which causes large and small apples to appear in the same bin. It is necessary to measure each apple by the same diameter to secure uniformity.

Another popular device for sizing consists of rollers or belts spaced close at one end and diverging toward the far end. The fruit progresses along these rollers or belts until a place is reached which is wide enough to allow it to fall through. Several machines employ this principle to great advantage. The most common one is equipped with an endless horizontal belt which is inclined in such a way that the fruit rolls toward the lower edge where it comes in contact with a revolving roller. (See fig. 7.) This roller is set at a height of 2¼ inches above the belt at one end and 3 inches above at the opposite end. This arrangement would provide for three sizes, 2¼ to 2½ inches, 2½ to 3 inches, and 3 inches and larger, the largest size being carried over the end of the belt. However, the roller is adjustable and may be set at various heights, depending upon the number of sizes desired.

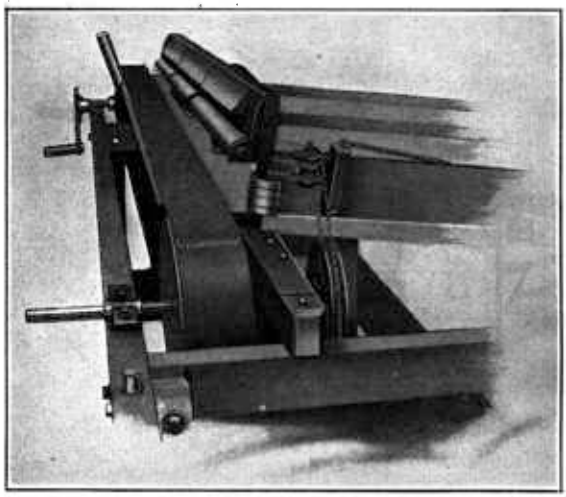

FIG. 7.—With this type of machine the fruit is sized in the slot between the roller and the horizontal belt.

Another machine, which employs this principle but in which a board is substituted for the revolving roller, may be constructed by the ingenious grower at a very slight expense. This machine is easily operated, inexpensive, simple in construction, does not bruise the fruit, and the speed is sufficient for an output of 100 to 150 barrels a day. In feeding the fruit to the machine care must be taken that all of the apples come in contact with the board so that they will be sized correctly. If too many are fed at one time, all will not touch the board.

Another similar arrangement consists of two spiral or corkscrew-like rollers which are set horizontally and which diverge in the same way as the machines which have been described. (See fig. 8.) The fruit is carried along the slot between the two rollers, which revolve away from each other. When a point is reached where the space between the rollers is wider than the diameter of the fruit the apples drop into the bin below.

In another type of machine the fruit is dropped into a series of cups or pockets, operated as an endless belt. (See fig. 9.) These cups or pockets enlarge as the fruit is carried along until the diameter is great enough to allow the apple to drop through into the bin.

The machines which have been described are usually operated by gas engines or electric motors, but practically all manufacturers put out small hand-power machines light enough to be moved about from place to place in the orchard.

In general, any of these machines will size apples satisfactorily for barrel packing. The choice of the machine will have to be made by the grower, based upon a consideration of the size of the orchard, the equipment already on hand, the accuracy required, and number of sizes desired. There are a number of points that growers should keep in mind in making this choice; (1) The machine must have a

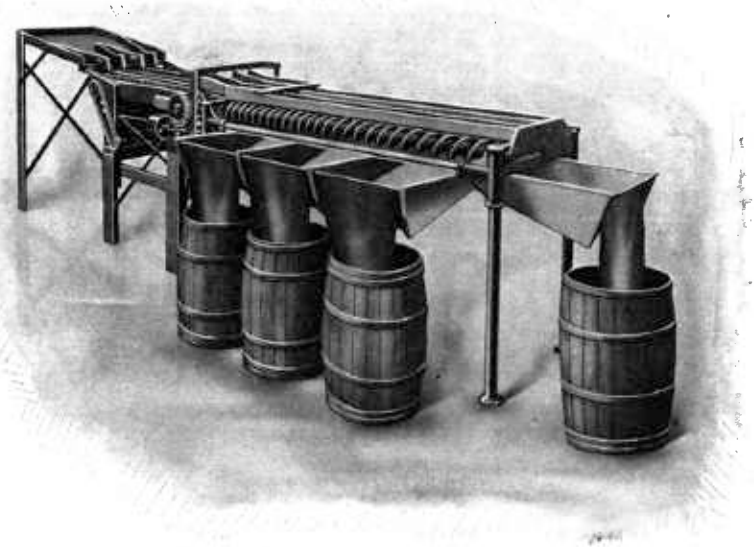

FIG. 8.—Sizing machine with diverging spiral rollers.

capacity proportionate to the size of the orchard so that the operation can be conducted economically. In choosing between two machines, one which has a large capacity but is only moderately accurate and the other which has a small capacity but is very accurate, such as those used in connection with box packing, the former is preferable in most cases. (2) Simplicity of design and freedom from too numerous adjustments are features very much to be desired. The machines that size most accurately are generally expensive, cumbersome, and fitted with numerous delicate adjustments which tend to make them undesirable for barreling operations, as barreled apples are usually sized in one-fourth inch variations and extreme accuracy is unnecessary for this purpose. (3) An investigation should be made to see that there are no arrangements or devices that will unduly bruise the fruit. If the apples are bounced along on metal or un-

padded parts, or if the construction in any way necessitates crowding or congestion, there is danger of injury, and such a machine will not be suited to tender varieties. (4) The durability of the machine is a matter of great importance. If such a machine is not substantial, it will soon go to pieces when subjected to the rough handling that is usually given such equipment.

ADDITIONAL EQUIPMENT FOR SIZING MACHINES.

Practically all sizing machines in use at present separate fruit of one grade into various sizes, but by dividing the grading belt lengthwise with a strip or pipe and rearranging the chutes which divert the fruit from the sizing device to the packing bins, two

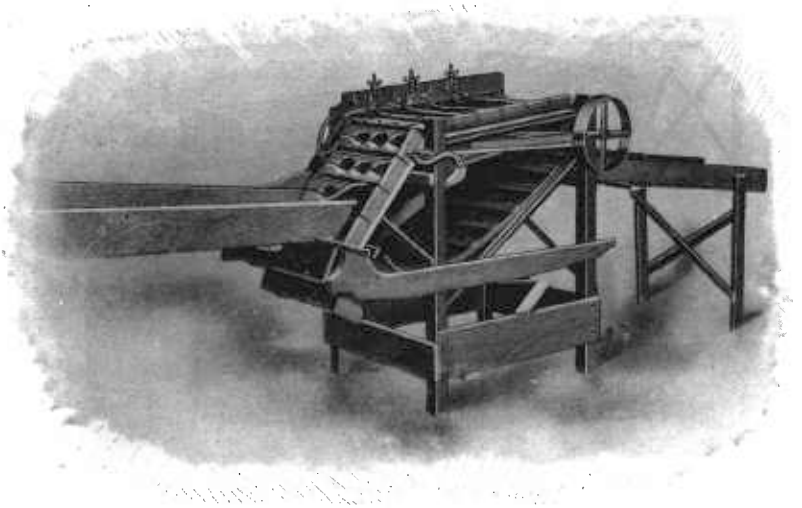

FIG. 9.—This machine sizes the fruit through cups which enlarge as the belt moves along.

grades may be sized at the same time. Assuming for the purpose of illustration that A and B grades are to be sized separately, the grading operation is carried on in the following manner: The field-run fruit is emptied on the belt and passes on both sides of the partition. The culls are first removed into containers provided for that purpose, then the sorters standing on the "A" side do not handle the "A" grade fruit but put the "B" grade across the partition, and the sorters on the "B" side permit the "B" grade fruit to pass, and put the "A" grade across. With this plan only 50 per cent of the fruit is handled, no matter what percentage of the crop falls in each grade, except such handling as may be necessary to determine the grade.

Perhaps a better way of dividing the fruit is to divert all the fruit to one side of the partition. Where this is done, the grade constituting the smaller part of the crop is sorted out and placed on

the opposite side of the partition. This requires the handling of a smaller percentage of the fruit than the other method, unless the crop is evenly divided between the two grades.

In most commercial operations the second grade fruit is not separated into various sizes, but all of it above a certain minimum diameter, usually 2¼ inches, is packed together. Instead of following the usual practice of sorting out this grade into baskets or barrels, a canvas conveyor 5 or 6 inches wide, placed about 18 inches above the table, may be used to advantage in carrying the fruit to a side bin at the end of the machine.

The efficient disposal of culls is a point which is very commonly neglected and often an accumulation of this fruit on the packing floor is allowed to interfere with the other operations of the crew. In many houses the culls may be conveniently carried to the basement by canvas chutes. Where this is done, they must be removed later by elevators or the house may be so constructed that it is possible to drive directly into the basement. Where there is no basement, conveying belts may be used to carry the culls to elevated bins, from which they can be removed through a trap into wagons.

The method of feeding the fruit to the sizing machine is another point to be studied carefully, as it influences directly the total daily output and consequently the cost of operation. In the first place, it should be possible to supply a continuous flow of fruit to the sizer without any tendency toward crowding or bruising, and, second, it should not be necessary to lift the filled containers to any considerable height from the floor in order to empty them, especially where the loose fruit is hauled in barrels. Unnecessary lifting may be avoided by elevating the receiving platform or floor about 30 inches above the main packing floor, or to a little less than the height of the sizing machine, thus permitting the emptying of the fruit at about floor level. With this feature of construction, the feeding can be still further facilitated by installing a belt 10 to 15 feet in length to receive the fruit. This belt ordinarily should extend along the receiving platform at right angles to the grading belt, thus making it possible to empty the loose fruit at any point along the line Extended observations indicate this to be the ideal arrangement.

Another method of feeding consists of pouring the fruit into a hopper on the floor level, from which it is carried to the sorting belt or sizer by means of an elevator belt. This method is in rather common use in sections where the loose fruit is hauled in barrels, and in some houses has given satisfactory results; however, without careful management, there is a marked tendency to bruise the fruit. In the first place, the man emptying the barrels may allow them to rest partially upon the fruit in the hopper; then when the hopper is full,

the elevating belt frequently carries several apples half way up the incline between the lugs and this fruit is generally bruised by rolling back into the hopper. The hopper method is also somewhat slower than the belt running on the level of the machine, as it is obvious that a feed belt carrying fruit on lugs placed several inches apart can not have as great a capacity as one running on the level. If a hopper is used it must be properly padded.

POWER.

Only the small machines can be operated by hand power. Some of the simple types, having a capacity of around 100 barrels a day, can be run in this way, but in nearly all cases the use of a gasoline engine or an electric motor is preferable. It is generally best to place the engine or motor in the loft or basement or under a shelter outside of the building in order to leave the packing house floor clear for the operation of the crew.

The speed of the machine needs to be regulated very carefully, as the accuracy and care with which the apples are handled are largely dependent upon the speed of the belts and chains. Practically all machines when run too rapidly are inaccurate and cause an excessive amount of bruising. When the conveyor belt delivers the fruit very rapidly to the sizer a congestion may result from the inability of the sizing device to size all of the apples delivered on it. When it is desirable to increase the output of the machine the fruit should be supplied in an uninterrupted flow rather than by increasing beyond normal the number of revolutions of the drivewheel.

CONVEYORS.

Two types of mechanical conveyors are used extensively in packing house operations—the endless chain or belt operated by machinery for conveying loose fruit or light packages, and the roller type for conveying filled packages by gravity. Chutes may also be used to advantage to convey fruit (especially culls), or packages to a basement or lower floor. The belts are made of heavy canvas or rubber fabric, and vary in width as desired. A smooth board is supplied as a floor over which the loaded part of the belt travels so that it will not sag or fold under the weight of the fruit. Canvas belts or chains fitted with lugs, and supported by a trough are used where the fruit is elevated or lowered.

The roller conveyors provide a convenient means of moving fruit in packages either packed or unpacked from place to place on the packing floor. This type of conveyor is especially useful in connection with the unloading of containers of fruit from the orchard. They are delivered to the end of the conveyor from the wagon and

are carried quickly to any part of the house desired. Where the fruit is to be carried from one point to another within the house, this operation may be performed more rapidly and with less labor expense by the use of gravity conveyors. In most cases two men can do the work of four without such equipment.

GRADING LAWS.

The enactment of grading laws for apples is a development of comparatively recent years. The first definite attempt toward securing the passage of such legislation was initiated in 1907 by a number of prominent growers, shippers, and dealers, who, after a protracted struggle lasting for several years, finally secured the passage of the present Federal law, commonly known as the Sulzer bill. This law served the valuable purpose of awakening and crystallizing public sentiment throughout the country favoring legislation which would stabilize the barreled apple industry by eliminating fraudulent and deceptive packing, and by establishing a uniform basis for buying and selling. In 1911, when the Sulzer bill was pending, a law based upon its provisions was passed by New York State. In August, 1912, the Sulzer law was signed by the President to take effect July 1, 1913. In 1913 the State of Maine passed a mandatory apple grading law. In 1914 New York passed a mandatory law which is still in effect in an amended form. This was followed by similar legislation in Massachusetts, Vermont, New Hampshire, Connecticut, Delaware, Kentucky, Maryland, Michigan, Pennsylvania, West Virginia, and Wisconsin. Apple grades have also been provided in Canada by the Canadian Inspection and Sale Act.

For several reasons the State laws have not been wholly successful in obtaining the desired results. In the first place the requirements of the laws have not been practical in all cases. Many of them were enacted hurriedly and most of them contained certain provisions which are not consistent with commercial practice, and, second, the extent to which these laws have been enforced in the different States has varied so greatly that in many instances the grade terms have come to have little or no value. Furthermore, the fruit from practically all of these States frequently appears in the same markets and the use of identical grade terms having different meanings in the different States has in a way defeated the purpose of the laws in that no grade term has ever stood for a standard pack. In spite of these objections, however, a State law that is practical in its specifications and intelligently enforced will carry with it many advantages. One of the most practical of the State laws has been enforced for a number of years and has given very favorable results. To be sure, there has been some dissatisfaction among certain growers during seasons when the fruit has been of generally poor quality,

but conditions on the whole have been greatly improved. The law discourages deceptive packing, and, by so doing, materially increases the demand for fruit grown in that State.

PACKING.

THE BARREL.

The minimum capacity of the apple barrel has been fixed by an act of Congress at 7,056 cubic inches, or somewhat over 3 bushels, and the "short" barrel is a thing of the past. Half and third barrels are permitted by this law, but they are used by growers only in rare instances where a fancy grade of fruit is shipped direct to the consumer. In certain parts of New England flour barrels, which are slightly larger than the United States standard barrel, are used to a certain extent.

Several kinds of wood are used in the manufacture of barrels, the principal ones being oak, pine, poplar, and birch. Barrels are usually coopered with six hoops, but in certain localities growers bind their barrels with eight hoops, using four instead of two quarter hoops. This practice insures greater strength, as the single quarter-hoops are often broken in handling and a barrel without quarter-hoops is very likely to be badly sprung. Barrels fitted with double quarter-hoops are stacked more solidly on the bilge as they are prevented to a certain extent from rocking. In certain parts of New England iron hoops have been adopted and are quite generally favored. They are forced into place and will hold securely without nailing in practically all cases, but the safest procedure is to secure the top hoops with two or three nails and avoid the possibility of their working loose. Wire quarter-hoops are commonly employed by some eastern growers, who claim that they fit more tightly and do not break as easily as do the wooden hoops. However, if wire hoops are broken or become untwisted at the joint, it is almost impossible to repair them without special equipment.

Two grades of barrels are made; the chief difference between them lies in the kind of wood used and the workmanship. The No. 1's are made from the better woods and more care is exercised in the selection of the hoops than in No. 2 stock. The heads of the No. 1's are usually made from two or three pieces while those of the No. 2's are frequently composed of four pieces. Barrels of the first grade are probably more economical on the whole, as those of the second grade frequently break and cause extensive loss in handling.

The barrel is generally delivered to the grower with both heads and all of the hoops in place, but with none secured by nails. This permits storing it indefinitely without danger of warping. Upon removing the barrel from storage one head is then nailed in and liners, which are thin gum strips, are tacked over the ends of the

pieces making up the head to prevent them from breaking out of the croze ring. The quarter hoops are secured by two nails on each side of the barrel. The other head is then removed and placed in the bottom of the barrel.

FACING.

The first step in packing a barrel is that of facing, or arranging the first and perhaps the second layer of apples in concentric rings on the bottom of the barrel. (See fig. 10.) Practically all growers use the single face, consisting of one layer, but the double face is used occasionally, especially for fancy fruit. The fruit is packed stem down except in the case of the second layer of the double face, which is often packed on the cheek. When the barrels are single faced they are backed up with a layer of "spotters," or apples dropped into the spaces between the apples of the face, so that the red cheeks face downward and show through to the best advantage when the barrel is opened. The "spotters" also keep the apples of the face in place when the remainder of the stock is poured into the barrel. The double face has no advantage over the single face and only tends to create a false impression of the rest of the contents.

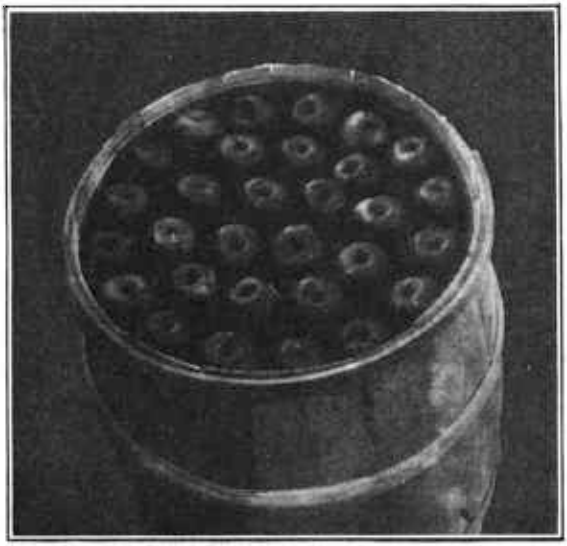

FIG. 10.—An excellent face made with 2¾-inch apples.

The advantages of the single face are three fold. First, it legitimately increases the attractiveness of the pack and draws the attention of the prospective buyers more readily than if there were no order of arrangement. Second, by carefully placing the first two layers in the bottom of the barrel, a large amount of bruising is avoided that might occur if the apples were dropped into place carelessly. Third, by placing the apples evenly over the surface of the head and then reinforcing them by spotters each one shares an equal amount of the pressure of the head and the amount of bruising is thus reduced to a minimum.

The chief objection to the practice of facing is that as a general rule only those apples of superior size and quality are considered desirable for this purpose. Unreliable packers have resorted to the

practice of facing with fruit far above the average quality of the barrel in order to deceive and defraud the buyer. There has been so much dissatisfaction and loss as a result of this method that a strong sentiment has developed among the growers and dealers in favor of enacting legislation requiring the face to represent fairly the average content of the barrel. Owing to the fact that the trade expects and customarily demands an attractive pack, the better-colored apples of uniform size may be placed in the face, but the general quality and size should conform to the grade of the remainder of the barrel.

FILLING THE BARREL.

After the barrel is faced, it is moved to the packing bin or grading table, where it is filled. Two methods of filling the barrel are used almost exclusively because they make it possible to lower the fruit into the barrel with a minimum amount of bruising. Filling is usually accomplished by the aid of a canvas or burlap apron attached to the grading table or packing bin, but it may be done equally well by the use of half-bushel baskets which are lowered into the barrel and emptied.

Where the slatted inclined table is used, or where a sizing machine sorts the fruit into packing bins, the apron attachment is employed, but where the fruit is emptied from field crates onto canvas-topped tables and is hand-sorted into half-bushel baskets, it is emptied directly from these baskets into the barrel. Either method is satisfactory if the packers employ a reasonable amount of care.

In addition to being carefully filled, a barrel must be packed tightly so that shrinkage and handling in transit or storage will not cause the pack to become slack. To insure a tight pack the apples must be settled thoroughly as they are placed in the barrel. This is done by racking.

"Racking" is a term used to describe the forced settling of the fruit by rocking a partially filled barrel back and forth in a sharp, jerky manner. (See fig. 11.) To produce a tight pack, the barrel must be racked after the first bushel is poured in upon the face and once again as each half bushel is added until properly filled for heading. The height of the fruit above the top of the barrel before heading varies ordinarily from one-half inch to 2 inches, depending largely upon the thoroughness of the "racking."

Under no circumstances should a grower omit "racking" and resort to overfilling as a means of making a tight pack, for no barrel which has been overfilled will pack as tightly as if is had been racked thoroughly to a height nearly level with the top. Pressing an overfilled barrel causes severe bruising all through the pack, but does not result in a thorough settling of the fruit. Though

apparently tight when pressed, it will settle later and become slack. From all the evidence available it is apparent that one-half to three-quarters of an inch above the top of the barrel is a sufficient height for the contents of any properly packed barrel.

FIG. 11.—"Racking" the apples.

TAILING.

Before pressing the head into place it is important to level the apples on the "tail" so that the pressure will be distributed equally. This is accomplished in one of two ways, either by roughly leveling off the high places or by arranging all of the apples exposed into a plate formation similar to that of the face. The first practice, which is in most common use, is known as "jumble-tailing," and

the latter practice is known as "ring-tailing." (See fig. 12.) The "ring-tail" is used to increase the attractiveness of the better grades. It also enables the grower to make a tight pack without injury from the pressure of the head. It is rather difficult for an inexperienced hand to arrange the "ring-tail" successfully, but a week's practice should enable the average person to put out 125 to 150 barrels a day.

The process of "tailing" is greatly facilitated by the use of the "follower" or "shaker," which is a heavy circular piece of wood made from 2-inch planks with a handle on top and thickly padded on the underside. It is fitted into the head of the loosely filled barrel, and being held in place during the racking operation it causes the fruit to settle with an even surface. The "follower" is applied to the full barrel if the "jumble" tail is used, but if the pack is "ring-tailed" it is applied before the barrel is quite full, so that the last layer of apples will bring the contents to the desired height before heading. The follower is universally used and favored, as it amplifies both methods of tailing.

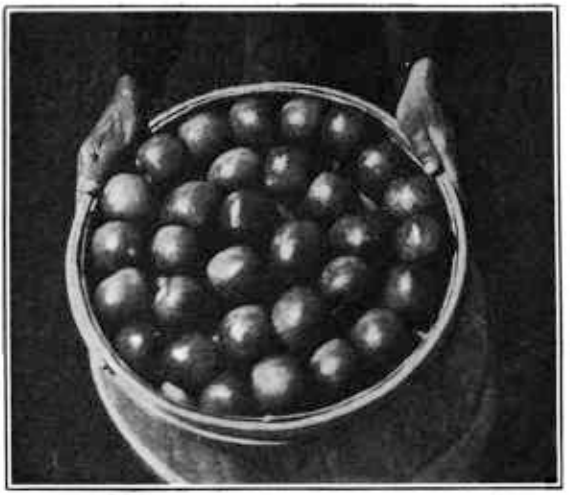

FIG. 12.—A good example of "ring-tailing."

PADS.

Corrugated pads are used by practically all growers to reduce the amount of bruising caused by pressing the head into place. If two pads are used, one is placed under the face and the other over the tail; if but one is used, it may be placed on either end, but it will serve best if placed on the tail end, especially when the apples are jumbled and exposed to the rough and frequently uneven pieces of the head which cut and bruise the fruit when the pressure is applied. Excelsior cushions are seldom used because they are more expensive and have no particular advantage over the corrugated pads in ordinary packing operations. If, however, a delicate and easily bruised variety is being packed for show purposes such pads may be used to advantage.

BARREL PRESSES.

The type of press used to head the barrel is a matter of considerable importance since there are two principles of construction involved, one of which is outstandingly superior to the other. The

pressure in one case is applied by means of a screw and in the other by means of a lever.

The screw press, shown in figure 13, although probably slower in operation than the lever press, is favored by a large majority of the apple growers, as it enables the packer to head the barrel with a minimum of bruising. This is possible because the pressure is exerted as a steady force which adjusts the head by degrees, and the severe shock that usually accompanies the use of the lever is avoided. Where the lever type of press is used it is not at all uncommon to see the header jump on the lever and bring the head into place with a crash, this causing severe bruises and skin breaks.

FIG. 13.—The screw press used for heading barrels.

An attachment to the screw press which has been recently introduced and which is being adopted rapidly consists of a platform on which the barrel rests when it is headed. When not equipped with such a platform, the press hooks onto the bottom of the barrel by means of iron strips that extend down each side. This arrangement is open to the serious objection that it is likely to break the bottom hoops as the head is pulled into place, especially if the barrels are old or damp, thus materially weakening the barrel for subsequent handling.

FIG. 14.—Nailing on the head liners.

NAILING.

When the head has been pressed into place, and the upper hoops have been tightened, the barrel is ready to be nailed. The nails should be driven through the top hoops at an angle of about 45°. Nails driven horizontally into the ends of the pieces making up the head

frequently split the wood and do not hold as securely as when driven at an angle. From six to eight nails will hold the three and four piece heads in place and the use of more is a waste, especially when as many as 12 to 15 are used. If barrels are to be handled roughly or are to be transported long distances they should be additionally strengthened by the use of "liners" nailed over the ends of the head pieces. (See fig. 14.) The use of liners tends to prevent the head from springing out of the croze when the pack is submitted to a severe strain.

PACKING HOUSES.

Many types of structures are used for apple-packing operations, ranging from tents and sheds to permanent buildings equipped with packing machinery. The most desirable type depends largely upon the size of the orchard and the section of the country in which it is located. In many places where the individual orchards are too small to justify the erection of modern packing establishments, such houses have been built and operated successfully as community enterprises. Such a plan has a much better chance of success if the roads in the district are good and the orchards are not too widely scattered. The community house enables the small grower to profit by the division of labor and the increased efficiency of labor-saving machinery, and the standardization of pack is also of marked advantage in disposing of the crop.

Packing houses can be discussed best on the basis of their equipment. Those having no labor-saving machinery other than the ordinary implements used to fill and head the barrel are in one class, while those equipped with sizing machines, gravity and belt conveyors, and various other mechanical devices constitute another class, regardless of the amount of floor space or the construction of the building in either case. Very often a large tent or shed will be filled with apron tables all operated independently of each other so that there will be no division of labor among the hands employed. Such a house can not reasonably be classed with one that is prepared to increase the number of barrels packed per man no matter how much greater is its total output.

The equipment of a house operating without machinery differs little from the usual field layout, and for that reason the following discussion is concerned primarily with the establishment of a modern packing house fitted with labor-saving devices designed to facilitate the various operations and to reduce the packing costs.

LOCATION.

In choosing the site for a packing house there are a few points which if kept in mind should enable anyone to select the proper location without difficulty. A community house, practically without

exception, should be located on a railroad to avoid the added expense of hauling the loose fruit to the packing house and the packed fruit to the railroad. This is particularly true where the packing house is built in connection with the storage house. Individual houses may also be located to advantage on the railroad if the roads from the orchard are good, but if they are not, there is too much difficulty in moving the unpacked fruit without injury.

If located at the orchard, the position of the packing house will depend largely on the lay of the land. If the land is level, it is sometimes an advantage to have the house in the middle of the orchard, thus reducing to a minimum the aggregate distance for hauling the unpacked fruit. When the road to the shipping station is good and will permit the hauling of heavier loads than can be pulled through the orchard the house should be placed on this road, and in a hilly orchard the house should be located where there is a minimum amount of uphill hauling.

Where it is desirable to have a basement storage, advantage may sometimes be taken of a slope to build a house with the receiving platform level with the wagon beds on the upper side and the floor of the basement level with the wagon road on the lower side. With this arrangement the fruit can be conveyed to the basement by gravity and removed without the expense of operating elevators.

LIGHTING.

In the construction of a house or in the remodeling of an outbuilding for use as a packing plant provision for an abundance of light is of first importance, for the thoroughness of the work is severely impaired where the fruit is partially in shadow. Light may be admitted into the packing house in several ways. Skylights and windows high up on the walls in sufficient number to light the interior thoroughly offer the most satisfactory lighting arrangement. Where the house is constructed with a loft the skylights can not be used, and the light must be admitted from the sides of the building, either through sliding doors and windows or through hinged doors that swing upward and outward. A large house that depends upon side illumination is likely to have a dark region toward the center, even though the sides may be entirely open, but if all tables and conveyor belts used for sorting are placed along the sides of the house the light will fall directly on them. Light shafts are used to increase the amount of natural illumination and white paint is applied to interiors to intensify and reflect whatever light is available. If artificial illumination is used, special care should be taken to have the lights for the sorting operations arranged so that there will be no shadows on the fruit. For this purpose reflectors in the shape of an inverted trough fitted with electric bulbs can be suspended over the grading belts or tables.

STORAGE ACCOMMODATIONS.

Every packing house should have adequate space for the storage of empty barrels and for the temporary storage of loose fruit from the orchard and packed fruit intended for storage or shipment.

If 50 per cent or more of the barrels needed for the crop can be stored in the house at one time there is little danger that the necessary supply will be lacking during the height of the season and the operations suspended, which frequently happens when the barrels are secured from day to day from a local cooperage. With this in mind, some of the growers in the East who pack out the largest crops use a barn or attached building for a barrel storage and lay in a large reserve supply.

A loft or second story immediately over the packing floor constitutes the most satisfactory barrel storage. If barrels are stored on the packing floor, the house must be unusually large to accommodate them or congestion and confusion will result. Where the floor is only large enough to accommodate the packing operations the storage of empty barrels, except the necessary working surplus, takes up space which can be used to better advantage for the accumulation of loose and packed fruit.

The floor space adjacent to the feeding belt should be devoted to the storage of enough field-run fruit to supply the crew for several hours or longer so that temporary interruptions in the delivery of fruit from the orchard will not affect the continuity of the packing operations.

It is also well to provide additional room for at least one day's output of packed fruit awaiting movement. A shortage of cars or of hauling facilities frequently prevents the removal of the fruit as rapidly as it is packed and space should be provided to accommodate such fruit temporarily without hindering the packing operations. This space may be provided on a covered platform which furnishes protection from the rain and sun.

VENTILATION.

Another important consideration is adequate ventilation throughout all parts of the house, especially those parts intended for the storage of fruit. Where the storage room for ungraded fruit, culls, or packed fruit is inclosed, abundant ventilation is needed. The main packing room will seldom lack this feature, owing to the number of windows required for proper lighting.

SUGGESTED FLOOR PLANS.

It is impossible to give here the exact specifications for building packing houses, but with the aid of several suggested floor plans cer-

tain desirable features of construction and arrangement for the convenient and economical handling of the fruit may be pointed out.

The type of house suggested in Plan 1 is designed for handwork operations where the ordinary apron or canvas top tables are used. (See fig. 15.)

The dimensions of this house are 30 feet by 60 feet, which, with a double apron table, should provide for an output of 200 barrels per day. For larger operations the floor space and number of units may be increased indefinitely. As will be seen, the house is divided into two sections, one to be inclosed for an empty barrel storage and the other to be left open on two sides for the packing room. The space available for the packing operations is increased by the addition of two covered platforms 5 feet wide extending along the open sides of the packing room. The driveways should be built so that the wagon beds will be on the level with these platforms in order to facilitate loading and unloading. The fruit is received on one platform and passes in an orderly manner through the packing operations to the other side of the house, where it is loaded on the wagons. The arrangement of the equipment is such that the work can be done without any unnecessary moving around or waste motion. The extra space in the packing room is provided for unpacked and packed fruit.

Plan 2 shows a house equipped with three grading machines which have a total capacity of approximately 1,200 barrels a day. (See fig. 16.) A house having a very similar plan is operated at Biglerville, Pa. This arrangement is particularly well adapted to a community house where fruit is being packed for a number of growers. The feeding belts marked *A* are a very desirable feature, as fruit may be emptied on the machine from practically any point along the receiving platform. The fruit passes over the sizing chain *B*, where the fruit smaller than the minimum size for packing is dropped into a cull chute *C* leading to the basement. The remainder of the fruit is then delivered to the grading belt *D*, where the culls are removed by the sorters and dropped into another branch of the cull chute. The grading belt may be divided as illustrated in the middle machine shown in this plan so that two grades may be sized simultaneously. In this case the sorters who work on both sides of the grading belt divide the fruit into two grades, which are placed on opposite sides of the division board *E*. The first size, which usually consists of all fruit from 2¼ inches to 2½ inches in size, passes through the rings marked *F* into the bins *G* and *GG*. But the fruit 2½ inches in diameter and larger is carried up the elevator belt *H* onto another belt *I*, which delivers the B fruit into bin *J* and the A fruit into the double bin *K*. This bin it fitted with a gate or deflector *L*, which when open fills the first compartment and when closed allows the second compartment to fill. Two bins are provided for this fruit because the

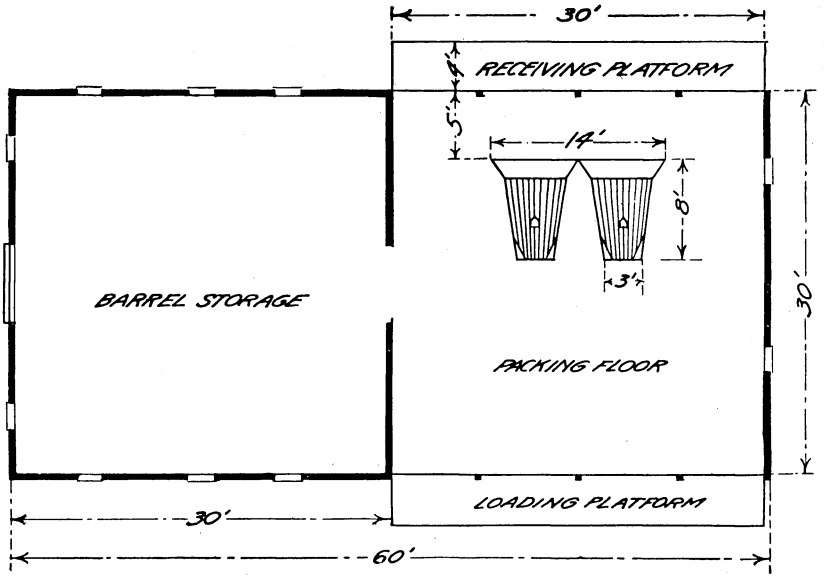

FIG. 15.—Plan 1: Floor plan of a packing house designed for handwork operations.

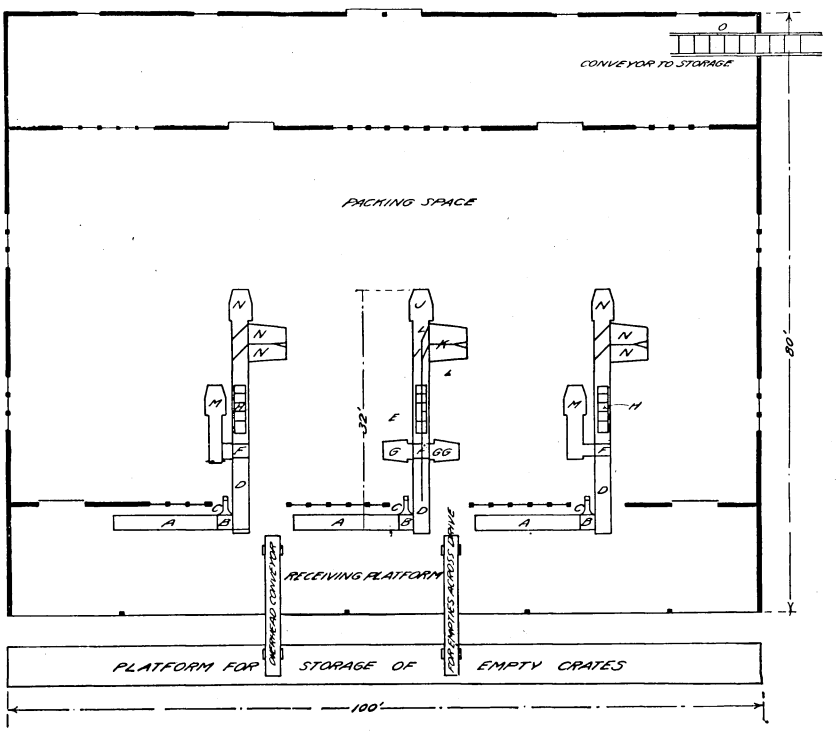

FIG. 16.—Plan 2: Floor plan for a community packing house with a capacity of 1,200 barrels a day.

bulk of the average crop runs A grade, 2½ inches and larger, and there must be bin space enough to accommodate all this grade when operating the machine continuously.

The end machines illustrated in this plan are not equipped to size two grades. Fruit of B quality is removed from the sorting belt into baskets and packed in the space behind the sorters, while the A fruit from 2¼ inches to 2½ inches passes through the sizing chains *F* and is conveyed into bins *M*. The bulk of the crop, which is A grade, 2½ inches and larger, is distributed among the three bins *N*. After the barrels are headed they are passed to the platform in the rear of the house, and from there may be transferred by means of the conveyor *O* to a storage or loaded on wagons and hauled to the cars. This house is equipped with two overhead conveyor belts for carrying empty crates across the drive from the main packing floor to the unloading platform. This arrangement keeps the whole area of the receiving platform available at all times for incoming fruit.

A loft should extend over the whole packing floor to serve as a barrel storage. The barrels may be coopered and stenciled here and lowered through shafts to convenient points on the packing floor. (See fig. 17.)

Plan 3 shows a house equipped with two machines having a total capacity of 1,000 barrels a day. (See fig. 18.) A house built and operated on this general plan was observed in Hancock, Md. The fruit is delivered on a receiving platform which extends the total length of the house. The fruit is emptied from the orchard containers onto the conveyor belts *A* at any point along the platform. These conveyor belts are elevated 8 inches above the receiving platform, which greatly facilitates the emptying of the crates. The receiving platform *B* is elevated 48 inches above the level of the packing floor. The sorters work on the platform *C*, which is elevated 18 inches. The machine has a total elevation of 56 inches, which makes it possible to deliver the fruit directly from the sizing chains into the packing bins by gravity. As the fruit passes over the first sizing rings at *D*, all the apples under the minimum size for packing drop into a chute which delivers them into a cull pile outside of the building. Sorters standing at the positions marked "X" remove the remaining culls and the B grade. The B grade is placed in baskets and emptied into bin *F*, which also contains the 2¼ to 2½ inch fruit. The remainder of the fruit is distributed to bins *G*, *H*, and *I*, which receive the sizes 2½ to 2¾ inches, 2¾ to 3 inches, and 3 inches and larger, respectively.

Apples of the various sizes which are selected for facing are carried to facing bins *J*. The full barrels are removed to the presses for heading. The barrel storage should be located in a loft over the packing floor, where the barrels are coopered, stenciled, and placed in racks *L*, from which they are removed by the persons doing the

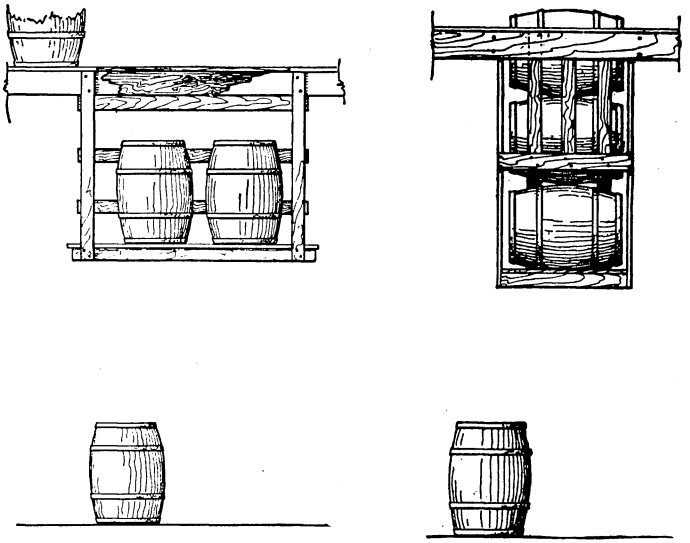

FIG. 17.—Two desirable methods of lowering empty barrels from the loft to the packing floor.

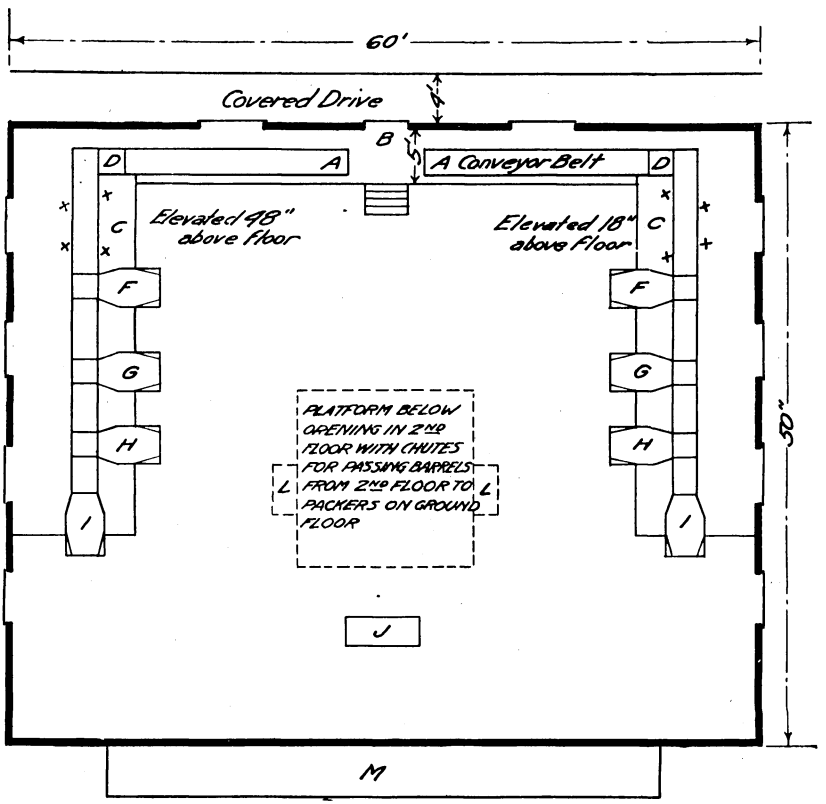

FIG. 18.—Plan 3: Floor plan for a well-arranged house capable of handling 1,000 barrels daily.

facing. Packed barrels awaiting shipment may be stored temporarily on the covered platform *M*.

In plan 4 an arrangement is suggested which embodies many of the features desired in a conveniently arranged packing house. (See fig. 19.) The overall dimensions of the house are 40 by 50 feet, with a total capacity of approximately 500 barrels per day. These dimensions, however, can be changed in case it is desirable to provide a larger space for the storage of unpacked and packed fruit. The actual floor space occupied by the packing machinery is 20 by 30 feet. A large loft over the packing floor is used for the storage of empty barrels. Barrels are also coopered in the loft and as they are needed are let down through the shafts *A*. This arrangement does away with an accumulation of empty barrels on the floor of the packing house, which would interfere with the operations of the crew.

The front of the house where the fruit is received is elevated 30 inches above the rest of the floor. The receiving space is enlarged by the addition of a 4-foot outside platform extending the width of the house. The feed belt *B*, which is 18 feet long and 2 feet wide, is raised 18 inches. The feed belt of an ordinary grading machine is approximately 3½ feet above the floor, and it is impracticable to empty barrels on a machine at this height. The fruit passes from the feed belt to the first sizing rings, where the cull fruit, smaller than 2¼ inches, is graded out. The fruit of a larger size passes to a grading belt *C*, which is 7 feet long and will accommodate six sorters. This belt is divided by a partition so that as the fruit passes along the B grade is sorted out and diverted into bin *D*. The culls are thrown into two chutes *E* leading to the bin outside the house. The A grade fruit passes to the next sizing rings, where the fruit 2¼ to 2½ inches in diameter is dropped into bin *F*. The remainder of the fruit is separated according to size into bins *G*, *H*, and *I*. Sorters stand on a raised platform 18 inches above the floor level. The machine is 48 inches above the floor and this height is sufficient to provide the proper drop to the packing bin. The fruit is loaded on the cars from a covered platform 6 feet wide and 80 feet long.

At the receiving end of the house there are three 10-foot doors hinged at the top to swing outward and upward. These doors when open form a cover to the platform and have the advantage of leaving the receiving floor free from obstruction. There are also 10-foot sliding doors at *J* on the side of the house and at *K* in the rear. Windows are provided on the sides of the house, and these, together with the doors, furnish an abundance of light for the packing operations.

Plan 4a illustrates the arrangement necessary for a house of the same capacity and construction as in plan 4, but equipped with a sizing machine of a different type. (See fig. 20.) The sizing mechanism is contracted into one unit, so that it is necessary to have the bins

close together and distributed on both sides of the machine. Practically the only other differences between these two houses are the location of the shafts through which the barrels are introduced to the packing floor from the loft above and the arrangement for the removal of the culls, which in this case are delivered to a bin outside the house by chain conveyor *C*. The arrangement shown in the two plans 4 and 4a cover the range of requirements for all standard grading machinery now on the market.

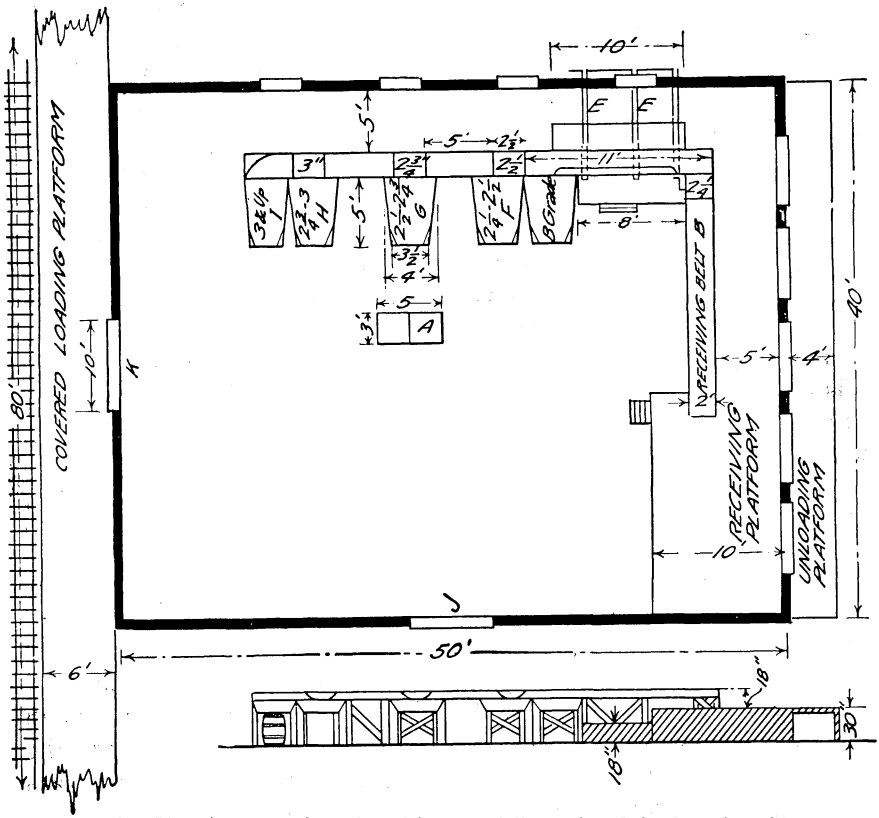

FIG. 19.—Plan 4: Floor plan of model house fully equipped for barrel packing.

HAULING.

As a large part of the barreled apple crop is packed at the orchard, it is usually necessary to haul the packed fruit from 2 to 15 miles to the shipping point, and it is important that this be done as rapidly and cheaply as possible and with a minimum amount of damage from shaking the pack and bruising the fruit.

Under many conditions, especially where good roads are available, motor trucks are best suited for such hauling on account of the combination of desirable features—speed, large capacity, and smooth carriage. Large trucks may be easily fitted with racks which make

it possible to haul 35 to 40 barrels at a load. Tractors are also used to some extent for hauling two or more wagons hitched together. (See fig. 21.) The time gained in hauling the fruit by trucks or tractors is important in expediting the movement of the crop into proper storage and also reduces the amount of labor necessary.

However, the great bulk of the crop is hauled in wagons, owing to the fact that in most cases the individual orchardist can not afford to maintain for this purpose trucks which he could use to advantage

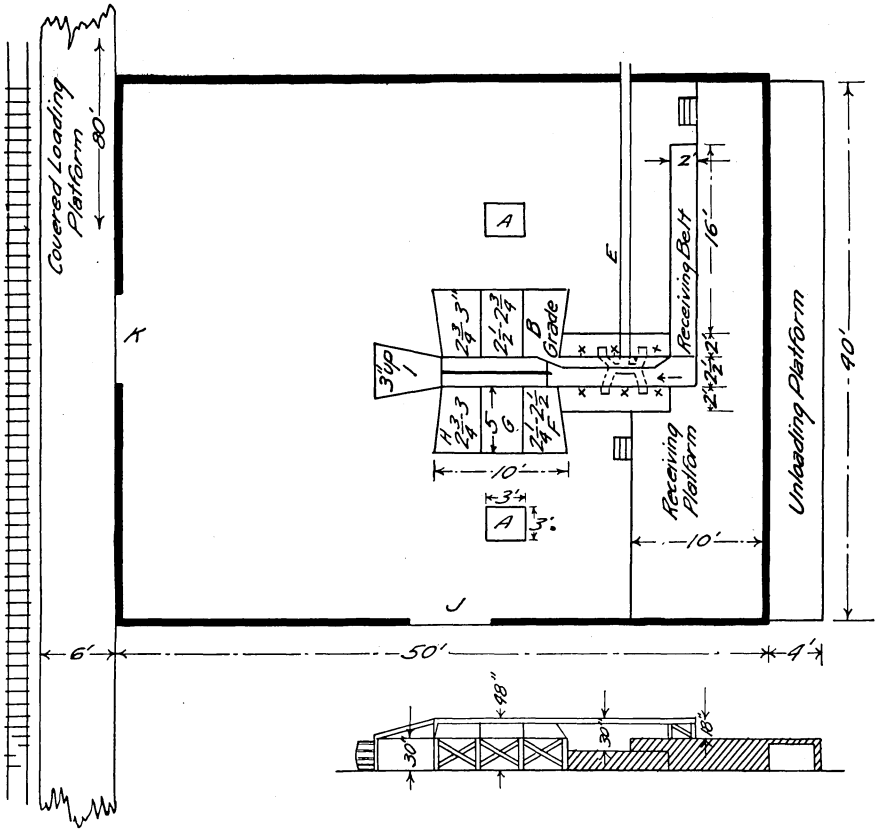

FIG. 20.—Plan 4a: Same as fig. 19, showing proper arrangement of a different type of sizing machine.

only a very short period of the year. The farm wagon customarily used is equipped either with an ordinary wagon bed or a three-pole frame and has a capacity of about 15 barrels. (See fig. 22.) The box bed is less desirable than the three-pole frame, because the barrels must be hauled on end, which subjects the pack to a much more sever strain than when the barrels are loaded on the side. With the three-pole wagon frame the barrels are loaded on the side and the poles are springy enough to give a certain amount of buoyancy to the load. Both types of wagons should be equipped with springs,

preferably with bolster springs which can be attached conveniently to any ordinary farm wagon. Indeed, the importance of springs can not be too strongly emphasized, for careful handling of the packed fruit is quite as important as care in any of the packing oper-

FIG. 21.—Small tractor hauling a load of 40 barrels.

ations. A rough, jolting haul will frequently impair the rigidity of the package to such an extent that it will not withstand the strain to which it is subjected in transit.

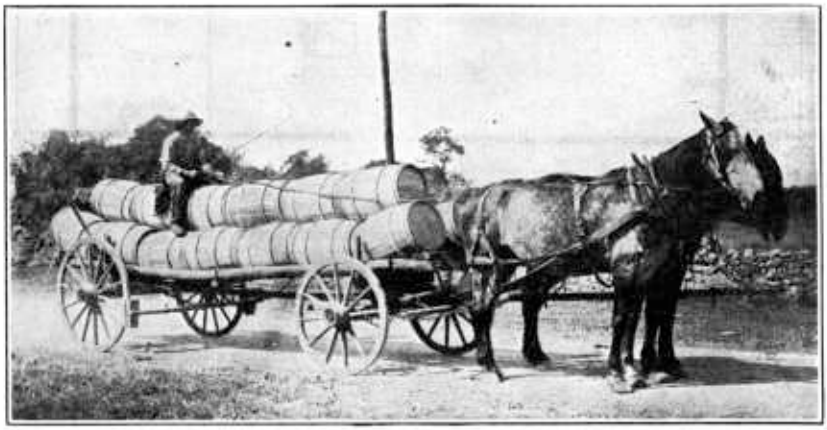

FIG. 22.—A three-pole wagon frame.

LOADING IN CARS.

A good system of loading must provide for the even distribution of the strain on the barrels, which must also be stacked tightly enough to avoid shifting and breaking. The barrels should be arranged in such a manner that adequate ventilation will be provided. The most popular and probably the most satisfactory method of loading is known as the alternating-straight load. (See fig. 23.) This load is

FIG. 23.—The "alternating-straight" method of loading.

FIG. 24.—The "staggered" method of loading.

started by placing two rows of three barrels each, end to end, across the car which leaves a space of about half the length of a barrel at the end of the rows. The second layer is then started by placing a row of three barrels on top of the first two rows but starting from the opposite side of the car and covering the open space between the ends of the rows below and the side of the car.

The remainder of the car is loaded in the same way, alternate layers being started from opposite sides of the car. This forms long channels along the walls lengthwise of the car which serve as flues for the circulation of air. When cars are shipped under refrigeration a load stacked in this manner will cool down quickly, or if a ventilated car is used there is a free circulation of air throughout the car. An additional advantage is derived from this method because the bilge of one barrel does not rest directly upon the bilge of another, but rests in the hollow space over the ends of four barrels below.

Another method of loading almost as popular and differing but slightly from the alternating-straight system is known as the "staggered" load, so called because of the fact that the alternate rows of each layer rest again opposite sides of the car. (See fig. 24.) This load is compact and carries very well, but not any better than the first method. The arrangement, however, does not provide as good ventilation and there is the further disadvantage that part of the barrels rest directly on the bilges of barrels in the layer below.

A number of other methods of loading are used to some extent in different sections, but these are not as desirable, for various reasons, as the two which have been described.

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